

**What is claimed is:**

5           1. A tissue invasive photonic system, comprising:  
a photonic lead having a proximal end and a distal end;  
a light source, in the proximal end of said photonic lead, to produce a  
first light having a first wavelength and a second light having a second  
wavelength;

10           a wave-guide between the proximal end and distal end of said  
photonic lead;

a radiation scattering medium at the distal end of the photonic lead to  
receive radiation from said wave-guide;

15           a plurality of power sensors to receive scattered radiation from said  
radiation scattering medium and convert the received scattered radiation into  
electrical energy;

a bio-sensor, in the distal end of said photonic lead, to sense  
characteristics of a predetermined tissue region; and

20           a distal emitter, in the distal end of said photonic lead and responsive  
to said bio-sensor, to emit a second light having a second wavelength to  
proximal end of said photonic lead such that a characteristic of the second  
light is modulated to encode the sensed characteristics of the predetermined  
tissue region.

25           2. The tissue invasive photonic system as claimed in claim 1, wherein  
said power sensors are alternately mounted circumferentially along a  
periphery of said radiation scattering medium.

3. The tissue invasive photonic system as claimed in claim 1, wherein said power sensors are electrically connected in series.

5 4. The tissue invasive photonic system as claimed in claim 1, wherein said radiation scattering medium has a decreasing radiation transmission rate along an axis of said radiation scattering medium.

10 5. The tissue invasive photonic system as claimed in claim 4, wherein said power sensors are electrically connected in series with consecutive sensors in an electrical circuit placed further along the axial direction of said radiation scattering medium.

15 6. The tissue invasive photonic system as claimed in claim 1, wherein said power sensors vary in size along an axis of said radiation scattering medium.

20 7. The tissue invasive photonic system as claimed in claim 6, wherein said power sensors increase in size along the axis of said radiation scattering medium towards a distal end of said radiation scattering medium.

8. The tissue invasive photonic system as claimed in claim 1, further comprising:

25 a proximal sensor, in the proximal end of said photonic lead, to convert the modulated second light into electrical energy.

9. The tissue invasive photonic system as claimed in claim 8, further comprising:

5 a transmitter, in the proximal end of said photonic lead and operatively connected to said proximal sensor, to transmit, in response the electrical energy from the converted modulated second light, information representing the sensed characteristics of the predetermined tissue region.

10 10. The tissue invasive photonic system as claimed in claim 1, wherein said distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the predetermined tissue region.

15 11. The tissue invasive photonic system as claimed in claim 1, wherein said distal emitter modulating the second light to create light having differing intensities over a period of time.

20 12. The tissue invasive photonic system as claimed in claim 1, further comprising a beam splitter to direct the second light to said wave-guide and to direct said first light to said plurality of power sensors.

25 13. The tissue invasive photonic system as claimed in claim 1, wherein said distal emitter is a transparent distal emitter transparent to the first light and producing the second light having the second wavelength.

14. The tissue invasive photonic system as claimed in claim 13,  
wherein said transparent distal emitter modulating the second light to create  
pulses of light having equal intensity and periods of no light, the periods of  
no light differing in time in response to the sensed characteristics of the  
predetermined tissue region.

15. The tissue invasive photonic system as claimed in claim 13,  
wherein said transparent distal emitter modulating the second light to create  
light having differing intensities over a period of time.

16. The tissue invasive photonic system as claimed in claim 13,  
wherein said transparent distal emitter is an organic light emitting diode.

17. A tissue invasive photonic system, comprising:  
a photonic lead having a proximal end and a distal end;  
a light source, in the proximal end of said photonic lead, to produce a  
first light having a first wavelength and a second light having a second  
wavelength;

a first wave-guide between the proximal end and distal end of said  
photonic lead;

a second wave-guide, having a plurality of power beam splitters  
therein at the distal end of the photonic lead to receive and reflect the first  
light from said first wave-guide;

a plurality of power sensors to receive the first light from said power  
beam splitters in said second wave-guide and convert the received first light  
into electrical energy;

a bio-sensor, in the distal end of said photonic lead, to sense characteristics of a predetermined tissue region; and

a distal emitter, in the distal end of said photonic lead and responsive to said bio-sensor, to emit a second light having a second wavelength to proximal end of said photonic lead such that a characteristic of the second light is modulated to encode the sensed characteristics of the predetermined tissue region.

18. The tissue invasive photonic system as claimed in claim 17, wherein said power sensors are electrically connected in series.

19. The tissue invasive photonic system as claimed in claim 17, wherein said power beam splitters have decreasing radiation transmission rates along an axis of said second wave-guide.

20. The tissue invasive photonic system as claimed in claim 17, further comprising:

a proximal sensor, in the proximal end of said photonic lead, to convert the modulated second light into electrical energy.

21. The tissue invasive photonic system as claimed in claim 17, further comprising:

a transmitter, in the proximal end of said photonic lead and operatively connected to said proximal sensor, to transmit, in response the electrical energy from the converted modulated second light, information representing the sensed characteristics of the predetermined tissue region.

22. The tissue invasive photonic system as claimed in claim 17,  
wherein said distal emitter modulating the second light to create pulses of  
light having equal intensity and periods of no light, the periods of no light  
differing in time in response to the sensed characteristics of the  
predetermined tissue region.

23. The tissue invasive photonic system as claimed in claim 17,  
wherein said distal emitter modulating the second light to create light having  
differing intensities over a period of time.

24. The tissue invasive photonic system as claimed in claim 17,  
further comprising a beam splitter to direct the second light to said wave-  
guide and to direct said first light to said plurality of power sensors.

25. The tissue invasive photonic system as claimed in claim 17,  
wherein said distal emitter is a transparent distal emitter transparent to the  
first light and producing the second light having the second wavelength.

26. The tissue invasive photonic system as claimed in claim 25,  
wherein said transparent distal emitter modulating the second light to create  
pulses of light having equal intensity and periods of no light, the periods of  
no light differing in time in response to the sensed characteristics of the  
predetermined tissue region.

27. The tissue invasive photonic system as claimed in claim 25, wherein said transparent distal emitter modulating the second light to create light having differing intensities over a period of time.

5 28. The tissue invasive photonic system as claimed in claim 25, wherein said transparent distal emitter is an organic light emitting diode.

29. An tissue invasive photonic system, comprising:  
a photonic lead having a proximal end and a distal end;  
10 a light source, in the proximal end of said photonic lead, to produce a first light having a first wavelength and a second light having a second wavelength;  
a wave-guide between the proximal end and distal end of said photonic lead;  
15 a plurality of power sensors to receive the first light from said wave-guide and convert the received first light into electrical energy, each power sensor absorbing a fraction of the received first light;  
a bio-sensor, in the distal end of said photonic lead, to sense characteristics of a predetermined tissue region; and  
20 a distal emitter, in the distal end of said photonic lead and responsive to said bio-sensor, to emit a second light having a second wavelength to proximal end of said photonic lead such that a characteristic of the second light is modulated to encode the sensed characteristics of the predetermined tissue region.

30. The tissue invasive photonic system as claimed in claim 29,  
wherein said power sensors are electrically connected in series.

5 31. The tissue invasive photonic system as claimed in claim 29,  
wherein said power sensors are stacked.

32. The tissue invasive photonic system as claimed in claim 31,  
wherein radiation captured is increased with increasing distance into the  
sensor stack.

10 33. The tissue invasive photonic system as claimed in claim 29,  
wherein said power sensors are concentric.

15 34. The tissue invasive photonic system as claimed in claim 33,  
further comprising a reflective grating to disperse radiation uniformly over a  
surface of said concentric sensors.

35. The tissue invasive photonic system as claimed in claim 29,  
further comprising:

20 a proximal sensor, in the proximal end of said photonic lead, to  
convert the modulated second light into electrical energy.

36. The tissue invasive photonic system as claimed in claim 35,  
further comprising:

25 a transmitter, in the proximal end of said photonic lead and  
operatively connected to said proximal sensor, to transmit, in response the

electrical energy from the converted modulated second light, information representing the sensed characteristics of the predetermined tissue region.

37. The tissue invasive photonic system as claimed in claim 29,  
5 wherein said distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the predetermined tissue region.

38. The tissue invasive photonic system as claimed in claim 29,  
10 wherein said distal emitter modulating the second light to create light having differing intensities over a period of time.

39. The tissue invasive photonic system as claimed in claim 29,  
15 further comprising a beam splitter to direct the second light to said waveguide and to direct said first light to said plurality of power sensors.

40. The tissue invasive photonic system as claimed in claim 29,  
20 wherein said distal emitter is a transparent distal emitter transparent to the first light and producing the second light having the second wavelength.

41. The tissue invasive photonic system as claimed in claim 40,  
25 wherein said transparent distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the predetermined tissue region.

42. The tissue invasive photonic system as claimed in claim 40, wherein said transparent distal emitter modulating the second light to create light having differing intensities over a period of time.

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43. The tissue invasive photonic system as claimed in claim 40, wherein said transparent distal emitter is an organic light emitting diode.

44. An tissue invasive photonic system, comprising:

a photonic lead having a proximal end and a distal end;

a light source, in the proximal end of said photonic lead, to produce a first light having a first wavelength and a second light having a second wavelength;

a wave-guide between the proximal end and distal end of said photonic lead;

a bio-sensor, in the distal end of said photonic lead, to sense characteristics of a predetermined tissue region;

a distal emitter, in the distal end of said photonic lead and responsive to said bio-sensor, to emit a second light having a second wavelength to proximal end of said photonic lead such that a characteristic of the second light is modulated to encode the sensed characteristics of the predetermined tissue region;

a power sensor to receive the first light from said wave-guide and convert the received first light into electrical energy; and

a plurality of switchable capacitors operatively connected to an output of said power sensor.

45. The tissue invasive photonic system as claimed in claim 44,  
further comprising a control circuit operatively connected between said  
power sensor and said plurality of switchable capacitors to control charging,  
switching, and discharging of said capacitors.

46. The tissue invasive photonic system as claimed in claim 44,  
wherein said control circuit switching said plurality of switchable capacitors  
into a series electrical circuit so that the voltage output of each capacitor is  
additive.

47. The tissue invasive photonic system as claimed in claim 45,  
wherein said control circuit switching said plurality of switchable capacitors  
into a parallel electrical circuit to enable simultaneous charging of said  
capacitors.

48. The tissue invasive photonic system as claimed in claim 44,  
wherein each switchable capacitor has a variable capacitance.

49. The tissue invasive photonic system as claimed in claim 45,  
wherein said control circuit switching said plurality of switchable capacitors  
to enable sequential charging of said capacitors with a pre-determined pulse  
intensity and duration.

50. The tissue invasive photonic system as claimed in claim 44,  
further comprising:

a proximal sensor, in the proximal end of said photonic lead, to convert the modulated second light into electrical energy.

5 51. The tissue invasive photonic system as claimed in claim 50, further comprising:

a transmitter, in the proximal end of said photonic lead and operatively connected to said proximal sensor, to transmit, in response the electrical energy from the converted modulated second light, information representing the sensed characteristics of the predetermined tissue region.

10 52. The tissue invasive photonic system as claimed in claim 44, wherein said distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the  
15 predetermined tissue region.

53. The tissue invasive photonic system as claimed in claim 44, wherein said distal emitter modulating the second light to create light having differing intensities over a period of time.

20 54. The tissue invasive photonic system as claimed in claim 44, further comprising a beam splitter to direct the second light to said waveguide and to direct said first light to said plurality of power sensors.

55. The tissue invasive photonic system as claimed in claim 44, wherein said distal emitter is a transparent distal emitter transparent to the first light and producing the second light having the second wavelength.

5 56. The tissue invasive photonic system as claimed in claim 55, wherein said transparent distal emitter modulating the second light to create pulses of light having equal intensity and periods of no light, the periods of no light differing in time in response to the sensed characteristics of the predetermined tissue region.

10 57. The tissue invasive photonic system as claimed in claim 55, wherein said transparent distal emitter modulating the second light to create light having differing intensities over a period of time.

15 58. The tissue invasive photonic system as claimed in claim 55, wherein said transparent distal emitter is an organic light emitting diode.